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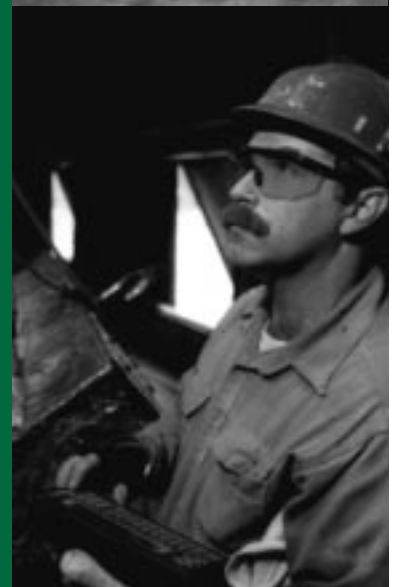
The Voluntary Aluminum Industrial Partnership

Pollution Prevention Program

A WINNING PARTNERSHIP FOR THE ENVIRONMENT

The Voluntary Aluminum Industrial Partnership (VAIP) is an innovative pollution prevention program developed jointly by the U.S. Environmental Protection Agency (EPA) and the primary aluminum industry. Participating companies (partners) work with EPA to improve aluminum production efficiency while reducing perfluorocarbon (PFC) emissions, potent greenhouse gases that may remain in the atmosphere for thousands of years.

Each partner in the VAIP program signs a Memorandum of Understanding with EPA in which they agree to undertake technically feasible and cost-effective actions to reduce PFC emissions. The partners also submit periodic reports to track emissions reductions. For its part, EPA agrees to work to improve the available information and understanding of the factors that influence the generation of PFCs, to encourage other aluminum producing countries to include PFC emissions in their respective Climate Change Action Plans, and to provide public recognition of the partners' efforts.



Since the VAIP program was launched in April 1995, membership has grown to include 12 of the nation's 13 primary aluminum producers, representing 22 smelters and 94 percent of U.S. production capacity. Many partners have already been successful in reducing their emissions. And while reduction goals vary according to site-specific conditions at each smelter, the partners have cumulatively committed to reduce PFC emissions 40 percent from 1990 levels by the year 2000. That's the equivalent of roughly 2.2 million metric tons of carbon — a clear win for the environment. VAIP partners also win, because fewer PFC emissions mean a more efficient aluminum production process and cost savings.

ALUMINUM PRODUCTION – IMPROVING AN ESTABLISHED PROCESS

Aluminum is produced in much the same way it has been produced for the last century, using the Hall-Heroult process. This process involves running an electric current between a carbon anode and a cathode, through a high-temperature bath of cryolite and aluminum fluoride. Alumina (Al_2O_3)—essentially bauxite, which is mined and transported to aluminum smelters—is fed into the bath at pre-determined intervals. When the current passes through the bath, the alumina is reduced to aluminum, which can then be removed or "tapped" from the bottom of the bath. The carbon anode is lowered into the bath and consumed during the production process. This reduction process takes place simultaneously at many smelting pots, connected electrically.

Primary aluminum production is the source of emissions for two PFCs, carbon tetrafluoride (CF_4) and carbon hexafluoride (C_2F_6). These PFCs are generated during anode effects, temporary electrochemical disruptions in the production process. When they occur, energy that would otherwise be used to make aluminum is wasted.

Under VAIP, partners work toward minimizing the number and duration of anode effects without sacrificing competitiveness. Many companies have already reduced their PFC emissions substantially through relatively minor technological and operational changes like employee training, use of computer monitoring, and changes in feeding techniques.

VARIATIONS ON A THEME

While the basic aluminum production process is a century old, variations have evolved over the years. The oldest technology, in place at several U.S. smelters, is the Soderberg reduction cell, in which the anode is formed and baked at the cell. A carbon paste is continually added to the anode and baked by the heat from the pot. Variations include Vertical Stud Soderberg (VSS) and Horizontal Stud Soderberg (HSS), indicating the orientation of the studs in the anode.

Prebake technology, in which the anode is baked in a separate process prior to use, is most prevalent in the U.S. primary aluminum industry. Prebake smelters can differ significantly in the way alumina is fed into the smelting pot. Sidework Prebake (SWPB) smelting pots feed alumina along the sides of the pot, while Centerwork Prebake (CWPB) smelters feed in the center. There is a further distinction between the "bar break" versus the "point feed" technique. Point feeding, which generally allows more control, is found in newer smelters.

These differences play a critical role in the amount of PFCs emitted. Since anode effects occur when there is too little alumina in the smelting pot, the way in which the alumina is fed and the frequency at which it is fed are important factors in determining how often anode effects occur.

VAIP TURNS CHALLENGES INTO OPPORTUNITIES

The VAIP is designed with important and unique characteristics that reflect both the diversity within the primary aluminum industry and the differences between this and other industries.

VAIP is flexible, allowing participating companies to tailor the program to reflect their own particular mix of technology, management structure, and operational practices. In addition to this flexibility, VAIP features a broad range of other benefits.

BENEFITS

- VAIP sets a clear course for substantial pollution prevention by the year 2000. The program provides partners with a framework for documenting their accomplishments, setting achievable goals, and tracking progress.
- VAIP provides partners with opportunities to receive the recognition they deserve for their pollution prevention initiatives through: advertisements and public service announcements, news articles and press releases, marketing materials, and awards for environmental and technical leadership.
- VAIP works with partners to sample emissions from smelters to improve our understanding of PFC emissions and how they relate to operating conditions.
- VAIP provides forums for producers to share information about emissions reduction techniques that work best for them.
- By sponsoring academic, industry, and government research, VAIP helps producers find the most cost-effective ways to reduce PFC emissions while enhancing production. For instance, EPA is funding anode effect research at the Massachusetts Institute of Technology, and gas standards development at the National Institute of Standards and Technology.

ALCAN

Alcan Ingot has implemented a program of evaluating anode effects and reduction cell alumina feed rates on a daily basis as a measure to improve process control and subsequently reduce the emissions of PFCs. Excessive numbers of anode effects are investigated and corrective measures are taken. Future programs include major expenditures to monitor reduction cell operations and improve the alumina feed requirements, which will directly result in lowering emissions of PFCs.

"We support the VAIP as a responsible demonstration of environmental stewardship."

ALUMAX

Alumax Inc. has initiated a series of programs to reduce PFC emissions, including: employee awareness, employee training, team-based management approach, improved alumina feed control, improved computer control, and modified operating procedures. In addition to reducing PFC emissions, Alumax anticipates realizing benefits from these activities, including: improved current efficiency, reduced aluminum fluoride consumption, and better electric power utilization.

"It was an opportunity to join an innovative voluntary environmental improvement program that also provides cost reduction benefits for the primary aluminum industry."

ALCOA

Alcoa USMS is improving process control to reduce PFC emissions. Since the early 1990s, Alcoa has been identifying smelting subprocesses that are key in achieving both economic and environmental success. While considerable progress has been made since 1990, Alcoa believes that there are still opportunities in areas such as control of the quality of alumina feedstock. Because anode effects have undesirable side effects, including increased power consumption and increased consumption rate of the carbon anode material, Alcoa expects positive economic benefits from these activities in addition to reductions in PFC emissions.

"It was the right thing to do for the environment and, furthermore, it was consistent with Alcoa's efforts to achieve higher levels of process control."

GOLDENDALE

Goldendale Aluminum Company has taken several actions to reduce anode effect frequency during the past couple of years. An employee involvement team regularly meets to identify, develop, and implement anode effect, voltage, and energy reduction measures. The team developed a predictive anode effect suppression program using the cell line computer system. Testing has shown an anode effect decrease, and the program has been implemented plant-wide. Goldendale expects that reducing anode effects will also reduce energy consumption and lower cell line emissions.

"To have the opportunity to work with EPA in a cooperative partnership to seek and implement cost-effective and technically feasible methods to reduce PFC emissions."

REYNOLDS METALS

Reynolds Metals Company's commitment to environmental responsibility has been a core value for the company since its founding in 1919. Today, social responsibility, which includes environmental performance, is one of Reynolds' six Corporate Values by which the company manages its worldwide businesses. Since 1970, the company has decreased anode effect events by 42 percent at its operating U.S. reduction plants. Reynolds is continuing its research on anode effects to achieve further improvement, and has also instituted the AWARE program, a company-wide employee involvement program to prevent pollution.

"To further our commitment to environmental responsibility."

COLUMBIA FALLS

Columbia Falls Aluminum Company has installed a computerized anode effect suppression system to reduce PFC emissions. This system, which is activated at a preset voltage, significantly reduces anode effect duration. Columbia Falls is also investigating the optimum alumina feed rate to reduce anode effects. In addition to reducing PFC emissions, the company expects these activities to reduce emissions of other gases as well.

"For obvious reasons, it is to everyone's benefit to reduce the release of pollutants to the atmosphere. Additionally, the program creates an incentive for employees to pay particular attention to pot operation, given the PFC goals we have set for the plant."

KAISER

Kaiser Aluminum is pursuing two main approaches for reducing PFC emissions: educating employees on both operating practices for reducing the frequency and duration of anode effects and on the environmental impacts of anode effects; and continuing to refine feed control strategies used by the computer system that manages cell operations. This combination of activities has proven effective for Kaiser and will produce benefits in addition to reducing PFC emissions. For example, the cost of the latest control strategy upgrade was offset significantly by the reduction in anode effect minutes per ton of aluminum produced.

"The VAIP allowed for a 'no regrets' response to the potentially critical, but not clearly understood, issue of global warming; and it is a practical program that offered the potential for a better approach to 'problem' solving than by possible solution by edict."

NORANDA

Noranda Aluminum, Inc. has reduced PFC emissions by improving its computer control systems. For example, in 1983, Noranda adopted a new control system that significantly reduced anode effects on a potline that began operation in that year. As a result of upgrades and continual improvement in potline operations, Noranda has reduced anode effects by more than 70 percent since 1990. In addition to reducing PFC emissions, these upgrades have improved energy efficiencies and process stability.

"It is an opportunity to support voluntary programs while showcasing improvements. We are hopeful that more voluntary programs will be part of future environmental efforts."

CENTURY

Century Aluminum is continuing to modify and develop operational and feed control strategies to reduce anode effects and resulting PFC emissions. These improvements will provide the benefit of increased cell operating efficiency as well as a reduction in PFC emissions. In spite of the physical and technological age of the facility, considerable progress has been made in PFC emission reductions since the 1980s as recognized by an EPA award for pre-1990 PFC emission reductions.

"The company has found its emissions reduction program has also improved operating efficiency. Century Aluminum views the VAIP as an excellent opportunity to voluntarily participate in a proactive environmental program."

NORTHWEST

Northwest Aluminum Company installed a computerized anode effect suppression system to reduce anode effect times. Northwest has also been investigating the optimum alumina feed rate to reduce anode effects. In addition to reducing PFC emissions, Northwest Aluminum expects these activities will reduce power consumption and other gas emissions.

"To demonstrate that through reduction of anode effects and PFC emissions, we will see a reduction in energy usage and better efficiency of the energy used—less energy used is always good for the environment."

NSA

NSA — A Division of Southwire has continually improved computer control systems and control programs to minimize the frequency and duration of anode effects, and thereby reduce PFC emissions. In addition to reducing PFC emissions, these efforts improve cell efficiency and reduce energy consumption, thereby reducing all emissions associated with primary aluminum production.

"The company is committed to being proactive in improving our environment. The VAIP is an excellent program for working toward the common goal of improving the world we all enjoy."

VANALCO

Vanalco, Inc. completed computerization of its potlines in the late 1980s and implemented anode effect suppression control. In 1995, upgraded computer hardware allowed increased sophistication of control of anode effects. As a result of these activities, Vanalco has achieved significant PFC reductions on the oldest operating potlines in the United States. Vanalco is continuing to develop process control programs that result in fewer anode effects, and expects that over time, reductions in PFC emissions through control of anode effects will lead to increased pot stability and reduced energy consumption.

"To support EPA's efforts to seek voluntary PFC reductions, allowing individual plant flexibility and ultimately the most effective reductions in PFCs."

EPA VOLUNTARY

ALUMINUM

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To learn more about VAIP,
call EPA at (202) 564-9044.